

09/955,115 6/2003

FILE: [Default FAS] Workspace [Pat Panel/LANDSCAPE].wpp1

FILE

File View Edit Tools Window Help

FILE

Drafts

Pending

Active

I1: (145) (205/81-82). CCLs.

I2: (12795) brightener or brighteners

I3: (2254) leveler or levelers

I4: (12) I1 and (12 or 13)

Failed

Saved

Favorites

Tagged (0)

UDC

Queue

Trash

Default order: OR

I1 and (I2 or I3)

Push

Highlight all items fully

U	PT	P	Document ID	Issue Date	Pages	Title	Current OR	Current XRef	Retrieval C	Inventor	S	C	3	3
1	P		US 6572753 B2	20030603	17	Method for analysis of three organic additives in an acid	205/81	205/101;		Chalyt, Gene et al.				
2	P		US 6569307 B2	20030527		Object plating method and system	205/82	205/296;		Blachier, Olivier J. et al.				
3	P		US 6565729 B2	20030520		Method for electrochemically depositing metal on a	205/82	205/148;		Chen, Ianlin et al.				
4	P		US 6508924 B1	20030121		Control of breakdown products in electroplating	205/81	205/123;		Gomez, Luis A. et al.				
5	P		US 6458262 B1	20021001		Electroplating chemistry on-line monitoring and	205/82	205/123;		Reid, Jonathan David				
6	P		US 6379520 B1	20020430		Plating apparatus	205/81	204/228. 6;		Kuriyama, Fumio et al.				
7	P		US 5906725 A	19990525		Method for preparing nickel-zinc-copper or	205/240	204/229. 2;		Lin, Jing-Chie et al.				
8	P		US 5888373 A	19990330		Method for repairing nickel-zinc-copper or	205/240	205/101;		Lin, Jin-Chie et al.				
9	P		US 5368715 A	19941129		Method and system for controlling plating bath	205/82	205/255;		Hurley, Michael P. et al.				
10	P		US 5223118 A	19930629		Method for analyzing organic additives in an	205/81	118/666;		Sonnenberg, Wade et al.				
11	P		US 5106552 A	19920428		Electroplating process	205/82	205/780. 5;		Desthomas, Guy				
12	P		US 4932518 A	19900612		Method and apparatus for determining throwing power	205/82	204/434;		Bernards, Roger F. et al.				

Document ID	Pages	1	2	3	4	5	6	7	Kind Codes	Source
US 6572753 B2	17								USPAT	
US 6569307 B2	13								USPAT	
US 6565729 B2	53								USPAT	
US 6508924 B1	11								USPAT	
US 6458262 B1	13								USPAT	
US 6379520 B1	21								USPAT	
US 5906725 A	6								USPAT	

US-PAT-NO: 6508924

DOCUMENT-IDENTIFIER: US 6508924 B1

TITLE: Control of breakdown products in electroplating baths

----- KWIC -----

Brief Summary Text - BSRX (3):

Electroplating is a complex process involving multiple ingredient, in a plating bath. It is important that the concentration of several of the ingredients be kept within close tolerances in order to obtain a high quality deposit. In some cases, chemical analysis of individual solution constituents can be made regularly (such as pH measurement for acid content), and additions made as required. However, other addition agents such as brighteners, leveling agents, suppressants, etc., together with impurities, cannot be individually analyzed on an economical or timely basis by a commercial plating shop. Their operating concentration is low and their quantitative analysis is complicated and subject to error.

Brief Summary Text - BSRX (6):

The electroplating of through-hole interconnections in the manufacture of multilayer printed circuit boards is an example of the use of an electroplating metal where high quality plating is required. It is known that the concentration of the organic additives, such as brighteners and levelers, within the plating solution must be maintained in low concentration (typically less than 100 parts per million parts of solution-ppm) in order to obtain acceptable deposits on printed circuit boards. This must be done to maintain proper mechanical properties for resistance to thermal stresses encountered during manufacture and use and to assure the proper thickness of the deposit in the through-holes and leveling. The concentration of the organic additive agents fluctuates because of oxidation at the anode. Reduction at the cathode, and chemical degradation. When the additive level is insufficient, deposits are burned and powder in appearance whereas excessive addition agents induce brittleness and non-uniform deposition. Hull cell tests, Bone Pattern tests, and Pencil tests, combined with periodic additions of fresh additives, were the methods used to maintain a control concentration of the additive until recently. These methods were unreliable and circuit board quality suffered as a consequence of these unreliable methods.

Brief Summary Text - BSRX (8):

U.S. Pat. No. 5,223,118 (Sonnenberg et al.) discloses a method for determining the quantity of brighteners and levelers present in an electroplating bath for the plating of printed wiring board substrates. In this method, the determination of both brightener and leveler is accomplished in one step.

Detailed Description Text - DSRX (4):

Many organic additives are used in metal electroplating baths, such as, but not limited to, leveling agents, brighteners, accelerators, suppressors, surfactants, wetting agents and the like. Certain organic additives are known to breakdown during the electroplating process to form breakdown products.

United States Patent

Gomez et al.

(10) Patent No.: US 6,508,924 B1
(45) Date of Patent: Jan. 21, 2003

(54) CONTROL OF BREAKDOWN PRODUCTS IN ELECTROPLATING BATHS

(75) Inventors: Luis A. Gomez, Paderborn, NY (US);
Kozella Becka, Bayport, NY (US);
Dennis Morrissey, Huntington, NY
(US); Eugene N. Slep, Newton, MA
(US)

(73) Assignee: Shipley Company L.L.C.,
Methuen, MA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 140 days.

(21) Appl. No.: 09/584,124

(22) Filed: May 31, 2000

(51) Int. Cl. C25D 21/18

(52) U.S. Cl. 205/81; 205/82; 205/99;

(58) Field of Search 205/123; 205/786.5; 205/787

(56) References Cited

U.S. PATENT DOCUMENTS

3,994,785 A * 11/1976 Rippe 204/10

FOREIGN PATENT DOCUMENTS

DE 199 11 447 A1 3/1999

* cited by examiner

Primary Examiner—Nam Nguyen

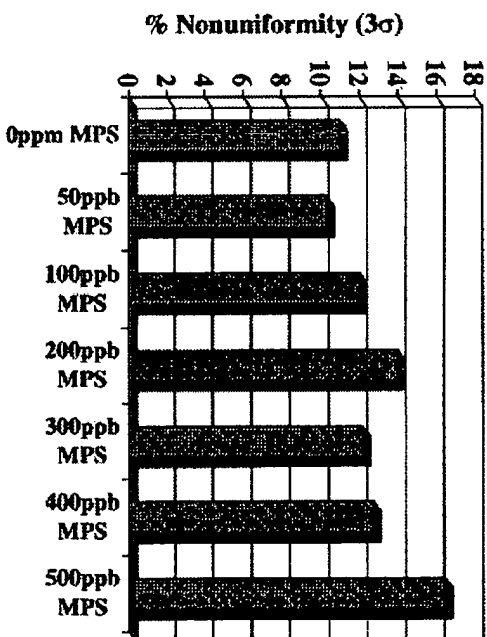
Assistant Examiner—William I. Lander

(74) Attorney, Agent, or Firm—S. Matthew China

(57) ABSTRACT

Disclosed are methods for analyzing additive breakdown products in electroplating baths as well as methods of controlling the presence of such breakdown products in electroplating baths.

11 Claims, 5 Drawing Sheets



Document ID	Pages	U	S	C	P	Kind Codes	Source
US 6572753 B2	17						USPAT
US 6569307 B2	13						USPAT
US 656729 B2	53						USPAT
US 6508924 B1	11						USPAT
US 6458262 B1	13						USPAT
US 6379520 B1	21						USPAT
US 5906725 A	6						USPAT

US-PAT-NO: 6379520

DOCUMENT-IDENTIFIER: US 6379520 B1

TITLE: Plating apparatus

----- KWIC -----

Detailed Description Text - DEXT (7):

With this construction, the power source 1-5 applies a predetermined voltage between the substrate 1-4 and anode 1-3, forcing metallic ions, such as Cu, sup. 2+ to be emitted from the soluble anode 1-3 (for example, a phosphorous copper electrode). The metallic ions emitted from the anode 1-3 are deposited on the surface of the substrate 1-4 to form a metal plating film. After continuously performing the plating process and processing a plurality of substrate 1-4, the composition, concentration, and amount of the plating solution 1-1 varies. In response to these variations, additive solution 2-4 from the replenishing tank 2-2 and plating solution 2-5 from the replenishing tank 2-3 are supplied to the regulator tank 2-1 to maintain the composition and concentration of the plating solution 1-1 at predetermined values. The additive solution 2-4 in the replenishing tank 2-2 is an organic additive solution comprising a mixture of a polymer, leveler, carrier, and HCl.

Detailed Description Text - DEXT (8):

With the construction described above, the power supply 11-5 applies a predetermined voltage across the substrate 11-4 and the anode 11-3, causing metallic ions such as Cu, sup. 2+ to emit from the soluble anode 11-3 (which is a phosphorous copper electrode, for example) and deposit on the surface of the substrate 11-4 to form a metallic film. After continuous plating operations and after performing the process on a plurality of substrate 11-4, the composition and concentration of the plating solution 11-1, as well as the amount of the plating solution 11-1, fluctuates. Based on the state of these fluctuations, the regulating tank 12-1 is replenished with additive solution 12-7 or plating solution 12-8 from the replenishing tank 12-2 or replenishing tank 12-3, respectively, in order to maintain the composition and concentration of the plating solution 11-1 at predetermined values. The additive solution 12-7 contained in the replenishing tank 12-2 is an organic additive solution comprising a mixture of polymers, levelers, carriers, and HCl.

Claims Text - CMTX (13):

6. A plating apparatus according to claim 5, wherein said organic additive solution comprises a mixture of a polymer, a leveler, a carrier, and HCl.

Claims Text - CMTX (81):

42. A plating apparatus according to claim 41, wherein said organic additive solution comprises a mixture of a polymer, a leveler, a carrier, and HCl.

Current US Original Classification - CCOR (1):

205/81

United States Patent

Kuriyama et al.

(10) Patent No.: US 6,379,520 B1
(45) Date of Patent: Apr. 30, 2002

(54) PLATING APPARATUS

FOREIGN PATENT DOCUMENTS

(75) Inventors: Fumio Kuriyama; Hisoyuki Ueyama; Junichi Yamakawa; Kenichi Suzuki; Atsushi Chono, all of Tokyo (JP)

JP 5-179496 7/1993
JP 10-121297 5/1998

(73) Assignee: Eisare Corporation, Tokyo (JP)

* cited by examiner

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: 09/601,084

(22) PCT Filed: Nov. 26, 1999

(86) PCT No.: PCT/JP99/06600

\$ 371 Date: Jul. 27, 2000

\$ 102(e) Date: Jul. 27, 2000

(87) PCT Pub. No.: WO00/32850

PCT Pub. Date: Jan. 6, 2000

(30) Foreign Application Priority Data

Nov. 30, 1998 (JP) 10-340576

Dec. 2, 1998 (JP) 10-342611

(51) Int. Cl. C25D 21/12

(52) U.S. Cl. 205/81; 204/238; 204/263; 204/269

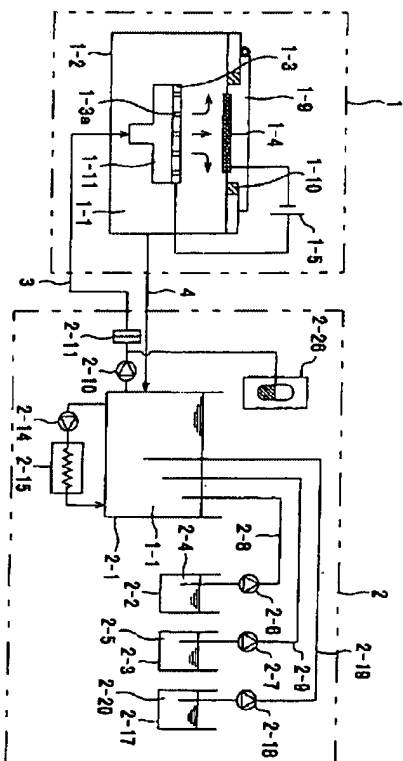
(58) Field of Search 204/232, 263, 269, 286; 205/82, 81

(56) References Cited

U.S. PATENT DOCUMENTS

3,658,470 A * 4/1972 Zivens et al. 23745

58 Claims, 10 Drawing Sheets



Document ID	Pages	U	S	C	P	Kind Codes	Source
US 6572753 B2	17	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		USPAT
US 6569307 B2	13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		USPAT
US 6565729 B2	33	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		USPAT
US 6508924 B1	11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		USPAT
US 6458262 B1	13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		USPAT
US 6379520 B1	21	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		USPAT
US 5906725 A	6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		USPAT

US-PAT-NO: 6458262

DOCUMENT-IDENTIFIER: US 6458262 B1

TITLE: Electropainting chemistry on-line monitoring and control system

----- KWIC -----

Brief Summary Text - BREF (6):

High-pressure liquid chromatography (HPLC) has been proposed as a method to monitor plating bath constituents by Taylor et al. "Electroplating Bath Control for Copper Interconnects," Solid State Technology, vol. 4, issue Nov. 11, 1998. In this article, the authors describe using HPLC to separate electrolyte species. Although HPLC techniques have improved dramatically over the past decade, this type of analysis has limitations with regard to plating bath composition. While organic additives such as accelerators, suppressors, and levelers are well suited for chromatographic separation, some important primary bath species, ions, metal salts, and acids are not. Analysis of purified bath components via chromatography can provide valuable information about organic plating bath electrolyte components, but only provides a partial picture of the plating environment.

Current US Original Classification - CCOR (1):

205/82

United States Patent

(10) Patent No.: US 6,458,262 B1
(45) Date of Patent: Oct. 1, 2002

ELECTROPLATING CHEMISTRY ON-LINE MONITORING AND CONTROL SYSTEM

Inventor: Jonathan David Reid, Sherwood, OR (US)

Assignee: Novellus Systems, Inc., San Jose, CA (US)

Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(d) by 53 days.

Appl. No.: 09/802,490
Filed: Mar. 9, 2001

Int. Cl.⁷ C21D 21/14
U.S. Cl. 205/82; 204/228; 204/229.2;
204/232; 204/237; 205/101;
Field of Search 205/82; 99, 101;
204/228.1; 228.6; 229.2; 232; 237; D1G. 13

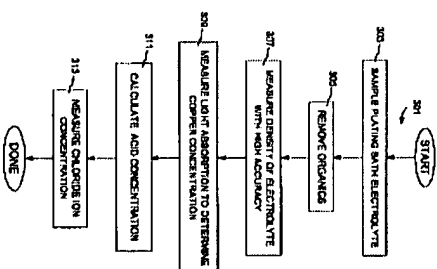
References Cited

U.S. PATENT DOCUMENTS

4,102,756 A • 7/1978 Cassiani et al. 204/43 T
5,352,350 A • 10/1994 Andriessen et al.
5,368,715 A • 11/1994 Harty et al. 205/82
6,029,856 A • 7/2000 Harty et al. 205/84
6,254,760 B1 • 7/2001 Shen et al. 205/535

OTHER PUBLICATIONS

Taylor, et al. "Electroplating bath control for copper interconnects," Solid State Technology, Nov. 1998, pp. 47-57.
Whelan, et al., "On-Line Monitoring of Chemical Processes in Electronic Components Manufacturing," Technol., Inc., pp. 1-8, Date of Publication Not Available.



36 Claims, 5 Drawing Sheets

Pat. Anon., "L-DENS-Liquid Density Transmitter for OEM Applications (Original Equipment Manufacturer)", Instruction Book, Mar. 12, 1996, pp. 1-30.
"Quali-Line™ AC-1000", ECI Technology, 1993, pp. 1-2.
Bentley, Peter, "New Development in the Use of Cyclic Voltammetric Stripping for Analysis of Plating Solutions", pp. N1-N28 (Date of Publication Not Available).
"Real Time Analyzer (RTA) Technical Manual", Technic of Providence, Rhode Island, pp. 1-19, Date of Publication Not Available.

* cited by examiner

Primary Examiner—Nann Nguyen
Assistant Examiner—William T. Leader
(74) Attorneys, Agent, or Firm—Beyer Weaver & Thomas, LLP

ABSTRACT

The present invention provides methods and apparatus for analysis and monitoring of electrolyte bath composition. Based on analysis results, the invention controls electrolyte bath composition and plating hardware. Thus, the invention provides control of electroplating processes based on plating bath composition data. The invention accomplishes this by incorporating accurate bath component analysis data into a feedback control mechanism for electroplating. Bath electrolyte is tested and analyzed in a flow-through system in order to identify plating bath component concentrations and based on the results, the plating bath formulation and plating process are controlled.

Document ID	Page	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238	1239	1240	1241	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255	1256	1257	1258	1259	1260	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272	1273	1274	1275	1276	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287	1288	1289	1290	1291	1292	1293	1294	1295	1296	1297	1298	1299	1300	1301	1302	1303	1304	1305	1306	1307	1308	1309	1310	1311	1312	1313	1314	1315	1316	1317	1318	1319	1320	1321	1322	1323	1324	1325	1326	1327	1328	1329	1330	1331	1332	1333	1334	1335	1336	1337	1338	1339	1340	1341	1342	1343	1344	1345	1346	1347	1348	1349	1350	1351	1352	1353	1354	1355	1356	1357	1358	1359	1360	1361	1362	1363	1364	1365	1366	1367	1368	1369	1370	1371	1372	1373	1374	1375	1376	1377	1378	1379	1380	1381	1382	1383	1384	1385	1386	1387	1388	1389	1390	1391	1392	1393	1394	1395	1396	1397	1398	1399	1400	1401	1402	1403	1404	1405	1406	1407	1408	1409	1410	1411	1412	1413	1414	1415	1416	1417	1418	1419	1420	1421	1422	1423	1424	1425	1426	1427	1428	1429	1430	1431	1432	1433	1434	1435	1436	1437	1438	1439	1440	1441	1442	1443	1444	1445	1446	1447	1448	1449	1450	1451	1452	1453	1454	1455	1456	1457	1458	1459	1460	1461	1462	1463	1464	1465	1466	1467	1468	1469	1470	1471	1472	1473	1474	1475	1476	1477	1478	1479	1480	1481	1482	1483	1484	1485	1486	1487	1488	1489	1490	1491	1492	1493	1494	1495	1496	1497	1498	1499	1500	1501	1
-------------	------	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	---